

SOFTWARE DISTRIBUTION SYSTEM AND SOFTWARE
RECEIVING TERMINAL APPARATUS

The present invention relates to a distribution system for distributing data or programs and a receiving terminal apparatus for receiving distributed data or programs, respectively via a satellite or a ground station.

Conventionally, distribution of data or programs (hereinafter described as software) is generally conducted by using storage media. Generally, a user installs distributed software by using storage media. If software can be automatically updated (including installation of new software), it is very convenient. In addition, without particular knowledge, new software can be updated and many people can use

Techniques regarding renewal of software is disclosed, for example, in JP-A-11-98477.

SUMMARY OF THE INVENTION

If all of distributed software received at a receiving terminal apparatus can be automatically updated simply in the reception order of software, the process at the receiving terminal apparatus is easy. However, in this case, data or programs which are

If a user is required to check distributed data or programs and determine the data or programs used for update and the update sequence, highly sophisticated technical knowledge is necessary and a work load is required.

It is another object of the present invention to provide a terminal apparatus capable of easily executing a necessary update process in accordance with distributed software.

20 According to another aspect of the present invention, distributed data or a program is checked whether it is required to be updated, and distributed data or program used for update are selected from distributed data and programs. After the update
25 sequence of distributed data and programs is determined, they are updated. In this manner, a terminal apparatus easy to use can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram showing the structure of a system according to a first embodiment of the invention.

5 Fig. 2 is a diagram showing the structure of
the system of the first embodiment.

Fig. 3 is a flow chart illustrating the operation to be executed by a station of the first embodiment.

10 Fig. 4 is a flow chart illustrating the
operation to be executed by a terminal apparatus of the
first embodiment.

Fig. 5 is a flow chart illustrating the operation to be executed by the terminal apparatus of the first embodiment.

Fig. 6 is a flow chart illustrating the operation to be executed by the terminal apparatus of the first embodiment.

Fig. 7 shows a list of software distributed
20 from the station of the first embodiment.

Fig. 8 is a terminal information table of the terminal apparatus of the first embodiment.

Fig. 9 is a diagram showing an extraction sequence for software relevant to the software possessed by the terminal apparatus of the first embodiment.

Fig. 10 is a diagram showing an extraction sequence for software relevant to the software

Fig. 20 is a display window used while

distributed software is received.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The first embodiment of this invention will be described with reference to Figs. 1 to 11. Fig. 1 is a diagram showing the structure of a system according to the first embodiment. The system of this embodiment is constituted of a terminal apparatus 150 and a station 100 which distributes data or programs to the terminal apparatus 150. Although the terminal apparatus for receiving data or programs may be mounted on a fixed facility, in this embodiment it is assumed that the terminal apparatus is mounted on a mobile unit. As an example of such a mobile unit, vehicles distributed in a broad area are used by way of example. The terminal apparatus may not be movable, and not only the vehicles but also other various mobile units may be used such as those used for overland transport and marine transport, and air planes.

Although a variety of apparatuses may be used as the terminal apparatus of the mobile unit, a typical example, a terminal apparatus with a car navigation function, is used in the following description.

Although there are many available media for distributing data or programs (hereinafter described as software) to be distributed, the system is assumed to use a satellite.

Either a geostationary satellite or a mobile

satellite may be used. In Japan, a geostationary satellite has a small angle of incidence so that buildings and geographical features greatly influence communications. The angle of incidence of a mobile
5 satellite is determined by its orbit. By properly selecting an orbit, the mobile satellite can move along an orbit just above Japan. In this case, radio waves can be transmitted along a zenith direction.

The system shown in Fig. 1 distributes
10 software by using a satellite as described above. The terminal apparatus 150 with a car navigation function receives distributed software and updates by itself software already possessed by the apparatus.

This system has: the station 100 for
15 distributing software to the terminal apparatus 150; and the apparatus 150 for receiving distributed software, the apparatus having a function of updating software possessed by the apparatus.

The station 100 has: a distribution side
20 communication unit 115 for distributing software to update software possessed by the terminal apparatus 150 and distributing a list of software to be distributed; a distribution software database 120 for storing distribution software; an encryption unit 110 for
25 enciphering software before it is distributed to the terminal apparatus 150; a distribution software list management unit 125 for managing a distribution software list described with the names and distribution

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the decryption unit 170; a display unit 197 for displaying map information or search information; and a terminal side control unit 180 for issuing a software update command to the software update unit 160, issuing
5 a software recovery command to the software recovery unit 170, and issuing an update sequence command to the update sequence management unit 190.

Fig. 2 illustrates how software is distributed from the station 100 to the terminal
10 apparatus in the vehicle. The station 100 distributes software and a distribution software list to a number of vehicles (vehicles 220, 225, 230 and 235) via an artificial satellite, e.g., a super ellipsoidal orbit satellite 210. The vehicles 220, 225, 230 and 235
15 transmit update contents to the station via the super ellipsoidal orbit satellite 210.

The super ellipsoidal orbit satellite 210 moves along an orbit (angle of incidence: 70° or larger) so that the vehicles 220, 225, 230 and 235 can see the
20 super ellipsoidal orbit satellite 210 in the zenith direction. By using such a satellite for software distribution, it becomes possible to prevent communication between the vehicles and satellite 210 from being interfered by high architectures such as
25 buildings. Since only direct waves from the satellite are received, it is possible to suppress the influence of reflected waves which generate noises.

An example shown in Fig. 2 is most

preferable. However, the embodiment is also applicable to the environments that the angle of incidence of the satellite 210 is low, there are obstacles in the communication paths, or reflected waves, or radio waves
5 are transmitted via an intermediary.

Figs. 3 to 6 are flow charts illustrating the operation of the first embodiment. The flow chart of Fig. 3 illustrates the operation of the station 100, and the flow charts of Figs. 4 to 6 illustrate the
10 operation of the terminal apparatus 150.

At Step 300 shown in Fig. 3, the distribution list management unit 125 forms a distribution software list describing therein the distribution contents of software and distribution schedule, the list being
15 distributed from the station 100. In forming the distribution software list, the distribution list management unit 125 inquires version information of a software group stored in the distribution software database 120 and determines a distribution time in
20 accordance with each of stored software. An example of the distribution software list is shown in Fig. 7.

Next, at Step 305 the distribution side communication unit 115 transmits a distribution start signal for 30 seconds to a number of terminal
25 apparatuses 150 in the vehicles, to thereafter follow Step 310. This distribution start signal is transmitted in response to a command from the distribution side control unit 105 which uses a

predetermined schedule.

On the side of the terminal apparatus 150, at Step 400 shown in Fig. 4 if the terminal apparatus 150 is not used, a standby mode is entered in order to
5 lower a power consumption of the terminal apparatus 150. The standby mode is a mode in which the frequency of control clocks is lowered to lower the execution speed of a command and suppress the power consumption and hence heat generation.

10 If the terminal apparatus 150 is in use for another purpose, the apparatus 150 operates for that purpose. For example, at Step 400 the terminal apparatus 150 may be in use for navigation by using the navigation unit 195 and display unit 197. If the
15 terminal apparatus has another function, it may be in use for this function.

After the distribution start signal is transmitted from the station 100 at Step 305, it is checked at Step 405 whether the terminal communication
20 unit 155 has received the distribution start signal. If received, at Step 410 the terminal side control unit 180 sets a reception mode so that the software group and distribution software list to be distributed can be received. Fig. 19 shows a display window of the
25 display unit 197 used when the terminal apparatus 150 is used for the navigation purpose. After a reception of the distribution start signal is detected at Step 405, as shown in Fig. 19, information indicating a

reception of the distribution start signal is displayed in a display area 1904 under a navigation display area 1902.

If there is no distribution from the station 100 and no distribution start signal is received at Step 405, then the standby mode continues or the terminal apparatus operates for its function to wait for the distribution start signal at Step 405.

On the side of the station 100, at Step 310 the distribution side communication unit 115 distributes the distribution software list formed by the distribution software list management unit 125 to the terminal apparatus 150 to thereafter follow Step 315.

On the side of the terminal apparatus 150, at Step 415 the terminal side communication unit 155 receives the distribution software list distributed from the station 100 to thereafter follow Step 420. When the list is received at Step 415, a display window shown in Fig. 20 appears and the navigation function is stopped to receive distribution software.

From Step 420 to Step 525, the update sequence management unit 190 selects software to be installed and checks an installation sequence.

At Step 420 the terminal side control unit 180 initializes a distribution number r of reference software in the received distribution software list, to $r = 0$.

The distribution software list will be described. Fig. 7 shows a distribution software list 700 distributed from the station 100. The distribution software list 700 stores therein: a distribution time 705 of each piece of software; a software number 710 sequentially and uniquely assigned to each piece of software, starting from "1"; a name 715 of distribution software; an installation type 720 indicating whether the software is update software or new software; a name (including a version) 725 of software updated by distribution software (up-data); a name (including a version) 730 of software to be updated by distribution software (up-data); an apparatus 735 compatible with installation software; and compatible software 740.

At Step 425 the terminal side control unit 180 increments the distribution number r of the reference software in the received distribution software list by "1". Next, at Step 430 the terminal side control unit 180 checks whether the distribution software list contains software having the distribution number r, in order to confirm whether all software in the distribution software list has been referred to. If the distribution software list contains software having the distribution number r, i.e., if all software in the distribution software list is not still referred to, then the flow advances to Step 435, whereas if the distribution software list does not contain software having the distribution number r, i.e., if all software

in the distribution software list has been referred to, then the flow advances to Step 600.

At Step 435, the update sequence management unit 190 refers to the software having the distribution number r in the distribution software list. At Step 440 the update sequence management unit 190 checks whether the reference software having the distribution number r is software already scheduled to install. If it is the software already scheduled to install, the flow returns to Step 425, whereas if not, the flow advances to Step 445. At Step 445 the update sequence management unit 190 checks whether the reference software is already possessed or not, by referring to the terminal information table 162 and checking whether the table contains software having the same name.

The terminal information table 162 will be described. Fig. 8 shows a terminal information table 162. The terminal information table 162 stores therein: a navi type number 805 representative of a type number of the terminal apparatus 150; an application name (including a version) 810 of an application possessed by the terminal apparatus 150; a driver name (including a version) 815 of a driver possessed by the terminal apparatus 150; a plug-in name (including a version) 820 of a plug-in possessed by the terminal apparatus 150; and a map data name (including a version) 825 of map data possessed by the terminal apparatus 150.

5 advances to Step 450.

to Step 425.

software and relevant software.

software "voice guide plug-in" 900, compatible software

necessary for running the "voice guide plug-in" 900 is checked by referring to the terminal information table 162 and checking whether the compatible software is already possessed. If it is already possessed, it is not necessary to install the relevant software, whereas if not possessed, the present software is required to be changed to the compatible software with version-up. Therefore, in order to search up-data for version-up, the compatible software is detected from the software name 730 after update in the distribution software list 700. The compatible software "navigator Ver. 4.0 or higher" for the "voice guide plug-in" 900 is not written in the terminal information table 162.

Therefore, from the software name 730 after update in the distribution software list 700, software "navigator Ver. 5.0" and "navigator Ver. 4.0" is detected.

Software necessary for updating to "navigator Ver. 5.0" is "navigator up-data Ver. 5.0" 905 and software necessary for updating to "navigator Ver. 4.0" is "navigator up-data Ver. 4.0" 910. It is checked whether these pieces of software 905 and 910 can be installed or not. First, compatible apparatuses with the software "navigator up-data Ver. 5.0" 905 and "navigator up-data Ver. 4.0" 910 are checked. Since the compatible apparatus with "navigator up-data Ver. 5.0" is "Navi3000", this software cannot be installed. Since the compatible apparatus with "navigator up-data Ver. 4.0" is either "Navi3000" or "Navi2000", this

5 "navigator up-data Ver. 4.0" 910 is "navi driver Ver.
4.0". It is checked from the terminal information
table 162 whether the navi driver Ver. 4.0" is already
possessed. Since the driver "navi driver Ver. 4.0" is
not still possessed, up-data necessary for driver
0 version-up is searched. Namely, "navi driver Ver. 4.0
is detected from the software name 730 after update in
the distribution software list 700.

Next, "driver up-data Ver. 4.0" 920 for updating to "navi driver ver. 4.0" is checked. From the distribution software list 700, it can be understood that the compatible apparatus with "driver up-data Ver. 4.0" 920 is either "Navi2000" or "Navi3000". It can therefore be understood that the terminal apparatus is compatible. It can then be understood that the compatible software is not required to use additional software necessary for running. It can further be understood that the software before update "navi driver Ver. 3.0" is written in the terminal information table 162, i.e., it is already possessed. From the above checks, it can be understood that "driver up-date Ver. 4.0" can be updated.

Next, "navigator up-date Ver. 4.0" 910 is again checked to confirm the software before update

5 from the software name 730 after update in the
distribution software list 700.

10 can be understood that the compatible apparatus with
"navigator up-date Ver. 3.0" 915 is either "Navi2000"
or "Navi3000" and that the apparatus is compatible.
Since the "driver up-data Ver. 4.0" already scheduled
to install can update the present driver to the
15 compatible software "navi driver Ver. 4.0", it can be
understood that the driver software is compatible. The
software name before update "navigator Ver. 2.0" of
"navigator up-date Ver. 3.0" 915 is written in the
terminal information table, i.e., this software is
20 already possessed. From the above checks, it can be
understood that "navigator up-date Ver. 3.0" 915 can be
installed.

25 can also be installed.

Next, the installation order of relevant software will be described. The relevant software is sequentially installed from the most downstream side of

software searched in a chain manner toward the reference software. In the case of "voice guide plug-in", for example, the installation order from the earliest becomes as in the following:

- 5 (1) "driver up-data Ver. 4.0" 920;
 (2) "navigator up-data Ver. 3.0" 915;
 (3) "navigator up-data Ver. 4.0" 910; and
as the last reference software,
 (4) "voice guide plug-in" 900.

10 Similarly, consider the case wherein "map
data '99 version" is installed. Fig. 10 illustrates an
example of extracting relevant software necessary for
installing "map data '99 version".

In installing "map data '99 version" 1000,
15 compatible software necessary for running the "map data
'99 version" 1000 is checked by referring to the
compatible software name 740 in the distribution
software list 700. The compatible software with "map
data '99 version" is either "navigator Ver. 5.0" or
20 "navigator Ver. 4.0". The compatible apparatus with
"navigator Ver. 5.0" is "Navi3000" so that the terminal
apparatus is not compatible. However, "navigator Ver.
4.0" is software scheduled to install when "voice guide
15 plug-in" 900 is installed. Therefore, "map data '99
25 version" 1000 can be installed.

Relevant software necessary for installing the reference software is extracted in a chain manner as described above, and thereafter the reference

software is installed from Step 500 to Step 525.

First, at Step 500 the update sequence management unit 190 checks relevant software necessary for the reference software. If it is determined at
5 Step 505 that the relevant software is all software already scheduled to install or software already possessed, the flow advances to Step 525, whereas if there is relevant software to be installed, the flow advances to Step 510. At Step 510 the update sequence
10 management unit 190 checks whether the relevant software group can be installed or not, by checking the compatible software 740 of the distribution software list 700 and the terminal information table 162. Next, at Step 515 it is determined whether the relevant
15 software group can be installed or not, by extracting the relevant software in the chain manner. In this case, it is also checked whether the total data amount of the software group to be installed is smaller than the capacity of the software temporary storage unit
20 185, by checking the software data size 745 written in the distribution software list 700. Namely, if the software can be stored in terms of capacity, it can be installed, whereas if not, it cannot be installed. If it is determined that the software can be installed,
25 the flow advances to Step 520, whereas if not, i.e., if the relevant software group is collected insufficiently, the flow returns to Step 425. At Step 520 the update sequence management unit 190 determines

the installation order of the relevant software group necessary for installing the reference software, in the manner described earlier. As described earlier, it is assumed herein that the relevant software is

5 sequentially installed from the most downstream side of software searched in a chain manner toward the reference software. Next, at Step 525 the update sequence management unit 190 determines the installation order of the reference software. In this
10 example, the installation order of the reference software is set to the next order to the installation orders of the relevant software determined at Step 520. Thereafter, the flow returns to Step 425.

The flow from Step 420 to Step 525 will be
15 described more in detail with reference to the distribution software list 700.

First, software "Internet browser Ver. 1.0" having the distribution number (1) of the distribution software list 700 is referred to, which is determined
20 as capable of being installed and given a first installation order. Next, "3D viewer plug-in" having the distribution number (2) is referred to, which is already possessed and not installed. Next, "voice guide line plug-in" having the distribution number (3)
25 is referred to, for which the relevant software is extracted in the chain manner as described above. Therefore, the second installation order is given to "driver up-data Ver. 4.0", the third installation order

is given to "navigator up-data Ver. 3.0", the fourth installation order is given to "navigator up-data Ver. 4.0", and the fifth installation order is given to "voice guide plug-in". Next, "map data '99 version" having the distribution number (4) is referred to. Since the relevant software "navigator Ver. 4.0" is already scheduled to install, the sixth installation order is given to "map data '99 Version". Next, "driver up-data Ver. 5.0" having the distribution number (5) is referred to, with which the terminal equipment is not compatible so that it is not installed. Next, "navigator up-data Ver. 5.0" having the distribution number (6) is referred to, with which the terminal equipment is not compatible so that it is not installed. Next, "driver up-data Ver. 4.0" having the distribution number (7) is referred to, which is already scheduled to install so that it is not given a new installation order. Similarly, "navigator up-data Ver. 4.0" having the distribution number (8) to be referred next is already scheduled to install so that it is not given a new installation order.

Since "navi driver Ver. 3.0" is already updated, "driver up-data Ver. 3.0" having the distribution number (9) to be referred next, is not installed. Since "navigator up-data Ver. 3.0" having the distribution number (10) to be referred next is already scheduled to install, a new installation order is not given. Since the terminal apparatus 150 has

updated software for ""driver up-data Ver. 2.0" having the distribution number (11) and "navigator up-data Ver. 2.0" having the distribution number (12), these two pieces of software are not installed.

5 With the above process, at Step 530 the update sequence management unit 190 forms an installation sequence table writing the installation sequence. Fig. 11 shows an installation sequence table. The installation sequence table 1100 has an
10 installation order 1105 and a name 1110 of software to be installed. The contents of the installation sequence table 1100 for the distribution software list 700 are:

15 1st: "Internet browser Ver. 1.0"
 2nd: "driver up-data Ver. 4.0"
 3rd: "navigator up-data Ver. 3.0"
 4th: "navigator up-data Ver. 4.0"
 5th: "sound guide plug-in"
 6th: "map data 99' version"

20 This installation sequence table is managed by the update sequence management unit 190.

 Next, a software distribution process at the station 100 and a software reception process at the terminal apparatus 150 will be described. First, the
25 process at the station 100 will be described.

 At Step 315 the distribution software encryption unit 110 enciphers a distribution software group by using a cipher key in order for the third

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received at Step 605 is the software written in the installation sequence table. If so, the flow advances to Step 615, whereas if not, the flow returns to Step 600.

5 At Step 615 the decryption unit 170 decipheres
the software written in the received installation
sequence table, and the deciphered software is
temporarily stored in the software temporary storage
unit 185. Next, at Step 620 the terminal side control
10 unit 180 checks whether all software necessary for
installation written in the installation sequence table
has been received. If not, the flow returns to Step
600, whereas if received, the flow advances to Step
625.

15 In the process from Step 625 to Step 650, the navigation unit 195 installs the received software in the navigation unit 195 in accordance with the installation sequence table.

At Step 625 the software possessed by the navigation unit 195 before the installation is backed up in the software temporary storage unit 185 in order for the software recovery unit 165 to recover the state of software before the installation in case the installation is failed.

25 Next, at Step 630 the software update unit
160 installs the software received by the process from
Step 600 to Step 620 in the navigation unit 195, in
accordance with the installation order written in the

Next, at Step 635 the update sequence management unit 190 determines whether the software installation at Step 630 has succeeded. If succeeded, the flow advances to Step 650 whereat the display unit 197 displays a message "update success" to thereafter follow Step 660. If the installation failed, the flow advances to Step 640.

At Step 660 the terminal side communication unit 155 transmits the updated contents of the software of the navigation unit 195, i.e., the software name and version, to the station 100 to thereafter follow Step 665. On the side of the station 100, at Step 325 the distribution side communication unit 115 receives the updated contents transmitted from the terminal apparatus 150. The updated contents are managed by the update contents management unit 130. In this manner, the updated contents at each terminal apparatus can be recognized.

power consumption at the terminal apparatus 150, to thereafter return to Step 405.

In this embodiment, software is distributed by using the satellite. Software may be distributed by using a digital ground wave broadcasting station. In this case, portable telephones, PHSes or the like are used for communications between terminal apparatuses and the digital ground wave broadcasting station.

As described above, during automatic update of a software group at each terminal apparatus, a plurality piece of relevant software can be updated without any dependency problem.

Next, the second embodiment of the invention will be described with reference to Figs. 12 to 18. Fig. 12 shows the structure of a system according to the second embodiment of the invention. In this embodiment, upon an update information transmission request from a user, information on hardware and software of a terminal apparatus or car navigation terminal apparatus in a vehicle is transmitted to a software management center via a satellite distribution system capable of transmitting and receiving radio waves in the zenith direction. In accordance with the information on hardware and software of the car navigation terminal apparatus, the software management center selects a software group to be updated and calculates an installation order or update sequence in order to ensure the installation without any dependency

problem. The software management center transmits the selected software group and the calculated update sequence to the car navigation terminal apparatus via the satellite distribution system capable of

5 transmitting and receiving radio waves in the zenith direction. The car navigation terminal apparatus temporarily stores the received information. Upon an update request from the user, the software is updated by using the temporarily stored software and update

10 sequence.

This system has a software management center 1200 and a car navigation terminal apparatus 1250. In accordance with information on hardware and software of the car navigation terminal apparatus 1250 received

15 from the apparatus, the software management center 1200 selects a software group necessary for updating the software of the car navigation terminal apparatus 1250 and calculates an update sequence of the software group to ensure installation without any dependence problem.

20 Thereafter, the software management center 1200 transmits the selected software group and calculated update sequence. The terminal apparatus 1250 transmits information on its hardware and software to the software management center 1200 and receives the

25 software group necessary for update and the update sequence sent from the software management center 1200 to update the software of the terminal apparatus 1250.

The software management center 1200 has: a

distribution side communication unit 115 for
transmitting software used for updating software of the
terminal apparatus 1250 and an update sequence table
for updating the software and for receiving the name
5 and version of hardware and software of the terminal
apparatus 1250 transmitted therefrom; an update
software database 120 for storing software necessary
for updating the software of the terminal apparatus
1250; an update software management unit 1205 for
10 managing an update software list of the software stored
in the update software database 120; an update sequence
management unit 190 for selecting a necessary software
group in accordance with the update software list of
the software stored in the update software database 120
15 and managing the update sequence of the selected
software group; and a distribution side control unit
105 for issuing a transmission command to the
distribution side communication unit 115 and managing
the whole control flow.

20 The update software list is generally the
same as the distribution software list of the first
embodiment. The different point is that the item
"software distribution time" in the distribution
software list is excluded. The update software list
25 writes the following items:

(1) a distribution number sequentially and
uniquely assigned to each piece of software, starting
from "1";

- (2) a name of software;
- (3) an installation type indicating whether the software is update software or new software;
- (4) a name (including a version) of software updated by distribution software (up-data);
- (5) a name (including a version) of software to be updated by distribution software (up-data); and
- (6) an apparatus compatible with installation software and compatible software.

10 The terminal apparatus 1250 has: a navigation
unit 195 for searching necessary map information,
displaying a map, and displaying a present location of
the user; a software update unit 160 for updating
software of the navigation unit 195; a terminal side
15 communication unit 155 for receiving software and an
update sequence list transmitted from the software
management center 1250; a software temporary storage
unit 185 for temporarily storing software received at
the terminal side communication unit 155; a software
20 decryption unit 165 for recovering the original software
of the navigation unit 195 once updated by the software
update unit 160; an input unit 175 for manipulating a
button for transmitting a software update request to the
software management center 1200 and manipulating a
25 button for starting software update; a display unit 197
for displaying map information or search information;
and a terminal side control unit 180 for issuing a
software update command to the software update unit

160, and issuing a software recovery command to the software recovery unit 170.

5 Figs. 16 to 18 show display windows of the display unit 197 used for a software update work. The software update work includes an "update software acquisition mode" and a "software update mode". In the "update software acquisition mode", information on hardware and software of the terminal apparatus 1250 is transmitted to the software management center 1200, and
10 a software group necessary for the update and an update sequence table are received from the software management center 1200. In the "software update mode", the software of the terminal apparatus 1250 is updated. Fig. 16 is a display window first displayed when an
15 update request is transmitted to the software management center 1200 in the "update software acquisition mode". Fig. 17 is a display window displayed while the update request is transmitted in the "update software acquisition mode", i.e., while the
20 software management center 1200 selects a necessary software group and calculates an update sequence. Fig. 18 is a display window displayed when software is updated in the "software update mode".

25 Figs. 13 to 15 are flow charts illustrating the operation of the second embodiment of the invention. Fig. 13 is a flow chart illustrating the operation to be executed by the software management center 1250. Fig. 14 is a flow chart illustrating the

operation to be executed by the terminal apparatus 1250 during the "update software acquisition mode". Fig. 15 is a flow chart illustrating the operation to be executed by the terminal apparatus 1250 during the

5 "software update mode".

When a user wishes to update software, the user makes the input unit 175 display the display window 1600 for the "update software acquisition mode". In order to display the display window 1600, the user

10 makes the input unit 175 display a mode setting dialog 1630 to be used for setting a mode, and in this state, an update software acquisition mode item 1640 is selected. In this manner, the display window 1600 is displayed.

15 The display window 1600 has an update request button 1610 for transmitting a software update request to the software management center 1600 and a cancel button 1620 for cancelling the software update process. When the user designates either the update request

20 button 1610 or cancel button 1620, the flow starts at Step 1400.

At Step 1400 a start process of starting the "update software acquisition mode" for the terminal apparatus is executed. Next, at Step 1405 it is

25 determined which one of the update request button 1610 and cancel button 1620 is designated. If the update request button 1610 is designated, the flow advances to step 1410, whereas if the cancel button 1620 is

designated, the flow advances to Step 1425. At Step
1410 the terminal communication unit 155 transmits the
names and versions of hardware and software possessed
by the terminal apparatus and written in the terminal
5 information table 162, to the software management
center 1200 via the satellite capable of transmitting
and receiving radio waves in the zenith direction. By
using such a satellite, a user can transmit necessary
information even in an urban district where influence
10 of buildings is susceptible and in a rural district
where a dead zone of portable telephones is broad, so
long as the user can see the sky.

On the side of the software management center
1200, reception of information from the terminal
15 apparatus is prepared at Step 1300. At Step 1305 the
distribution side communication unit 115 continues a
polling operation until the software update request is
issued from a terminal apparatus. If an update request
is received at Step 1305, the flow advances to Step
20 1310 whereat the distribution side communication unit
115 receives the names and versions of hardware and
software written in the terminal information table 162
and transmitted from the terminal apparatus 1250.
Next, at Steps 1315 and 1320, in accordance with the
25 update software list managed by the update software
management unit 1205, the update sequence management
unit 190 selects a software group necessary for
updating the software of the terminal apparatus 1250

and calculates an update sequence to ensure the update by the selected software group without any dependence problem, i.e., calculates an installation sequence table. The process of selecting a software group and
5 the process of calculating the update sequence are the same as those corresponding processes of the first embodiment (from Step 420 to Step 530). The update software list management unit 1205 updates the update software list each time the contents of the
10 distribution software database 120 are updated.

Next, at Step 1325 the distribution side communication unit 115 transmits the software group necessary for update selected by the update sequence management unit 190 and the install sequence table
15 writing the update sequence of the selected software group, to the terminal apparatus 1250 via the satellite capable of transmitting and receiving radio waves in the zenith direction. Thereafter, the flow returns to Step 1305 to continue the polling operation for a new
20 update request.

Next, on the side of the terminal apparatus 1250, at Step 1415 the terminal side communication unit 155 receives the update software group and installation sequence table necessary for updating the software of
25 the terminal apparatus 1250. During the process from Step 1410 to Step 1415, the display window 1700 is displayed on the display unit 197, the display window indicating the state of under transmission of an update

5 transmission" is displayed in the display window 1700.

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10  an "update software acquisition mode" end process.
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15 window 1800 is displayed on the display unit 197.

20 software of the terminal apparatus 1250 and a cancel

25 which one of the software update button 1810 and cancel

1810 is designated, the flow advances to Step 1510.

whereas the cancel button 1820 is designated, the flow advances to Step 1545.

If it is determined at Step 1505 that the cancel button was designated, the update process is terminated and an end process is executed at Step 1545. However, a user may display the mode setting dialog 1630 and select the "software update mode" 1650 by using the input unit 175, to call again the installation process. In this case, the received software group and installation sequence table stored in the software temporary storage unit 185 are used for updating the software of the terminal apparatus 1250. In this manner, either the case wherein the user wishes to use the car navigation terminal apparatus immediately after the reception end or the case wherein the user wishes not to update the software immediately after the reception end, can be dealt with.

At Step 1510 the software possessed by the navigation unit 195 before the installation is backed up in the software temporary storage unit 185 in order for the software recovery unit 165 to recover the state of software before the installation in case the installation is failed.

Next, at Step 1515 the software update unit 160 installs the software group stored in the software temporary storage unit 185, in the navigation unit 195, in accordance with the installation sequence in the installation sequence table stored in the software

Next, at Step 1520 the software update unit 160 determines whether the software update at Step 1515 has succeeded. If succeeded, the flow advances to Step 1525, whereas if failed, the flow advances to Step 1535.

If failed, at Step 1535, in order to recover the state of the software in the navigation unit 195 before the update, the software recovery unit 165 installs the software before update backed up in the software temporary storage unit 185, in the navigation unit 195. At Step 1540 the display unit 197 displays a message "update failure" to thereafter follow Step 1545.

As described above, during automatic update of a software group at each terminal apparatus, a plurality piece of relevant software can be updated without any dependency problem. Further, the software management center is provided with the update sequence management unit so that the circuit of the terminal apparatus can be simplified. Since the software

temporary storage unit for temporarily storing a software group necessary for the update is provided, a user can update the software at any time the user desires.

5 According to the first and second
embodiments, an update sequence management means is
provided for extracting up-data in a chain manner
necessary for updating software and managing the update
sequence of the extracted up-data. Therefore, a
10 plurality piece of relevant software can be updated
without any dependency problem.

Updating is possible even if a user has no highly sophisticated technical knowledge.

Even if there occurs any trouble during
15 updating, a user without technical knowledge can
recover the original state, which provides a high
reliability.

An apparatus or system easy to use can be provided.